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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,702	09/28/2006	Ryoichi Okuyama	KPO-004	1795

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EXAMINER	
BARROW, AMANDA J	
ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/594,702	OKUYAMA ET AL.	
	Examiner	Art Unit	
	AMANDA BARROW	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 November 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *47-77* is/are pending in the application.

4a) Of the above claim(s) *49,50 and 54-57* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *47,51-53 and 58-77* is/are rejected.

7)☒ Claim(s) *48* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 September 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/28/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species 1 in the reply filed on 11/13/2009 is acknowledged. Claims 49, 50, and 54-57 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 47, 51-53, 58-62, 64, 65, 67, 70-74, 76 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosek et al. (US Patent Application 2003/0062268) in view of Narayanan et al. (US Patent Application 2003/0226763) and evidenced by "Chemical Reaction" from Britannica Online Encyclopedia.

Regarding claim 47, Kosek discloses a hydrogen generating stack 12 which generates hydrogen gas by decomposing an organic fuel such as methanol (paragraphs 16 and 34) and comprises a membrane 18, an anode 16 ("fuel electrode") on one surface of the membrane 18, and a cathode 20 ("oxidizing electrode") on the other surface of the membrane 18 (see Figure 1; paragraph 16). Kosek teaches a pipe/channel that introduces methanol and water to the anode 16 (see Figure 1; paragraphs 16 and 34) and that the protons and some water are transported across the PEM to the cathode side of the cell 30. The protons are reduced along the cathode by externally transported electrons to form humidified hydrogen which is released from the cell and collected into a gas storage cylinder (paragraphs 4 and 24). Thus, the protons supplied act as the "oxidizing agent" as an "oxidizing agent" is defined as a species that gains electrons as evidenced by the article "Chemical reaction" from Britannica Online Encyclopedia.

Kosek discloses that the hydrogen generation system can be used for transportation applications including on board a vehicle (paragraph 4). Kosek does not specifically disclose that the hydrogen generation device is provided on an electric automobile and supplies hydrogen to a fuel cell which powers a motor; however, this concept is well known in the art. Narayanan discloses such a system in which a fuel cell 520 is supplied with hydrogen from an electrolyzer 100 (analogous to the hydrogen generating stack 12 of Kosek) and the electricity generated from fuel cell is supplied to an engine to power an electrically-driven vehicle (see Figure 5; paragraphs 78 and 80).

Therefore, it would have been obvious to a person of ordinary skill in the art to place the electrolyzer of Kosek on the electric automobile system of Narayanan because Kosek teaches that the hydrogen generation system can be used for transportation applications and Narayana

teaches a similar electrolyzer on board an electrically-driven vehicle and that such a system is widely used due to the simplicity of the electrolysis process equipment and its positive effects on the environment as the production of carbon monoxide is minimized (paragraphs 5 and 78-80).

Furthermore regarding claim 47, the claims recite means-plus-function which invokes a 35 U.S.C. 112, sixth paragraph limitation (see MPEP 2181). The claim recites, "means for supplying a fuel," "means for supplying an oxidizing agent," and "means for generating and collecting the gas containing hydrogen." The Applicant's specification supports and illustrates this language with the means for supplying fuel and oxidizing agents as feed channels the means for generating and collecting the hydrogen as a storage tank (see page 33 of the specification and Figure 2). The prior art applied (Kosek) teaches the same "means" as aforementioned in the rejection of claim 47.

Regarding claim 51, Kosek teaches that the electrochemical hydrogen generator comprises stacks with one or more cells that each contain the electrode assembly illustrated in Figure 1 (paragraph 5).

Regarding claims 52 and 53, Kosek teaches that operating the electrolyzer at near atmospheric pressure allows for the use of lower current densities without the decrease in faradaic efficiency. Decreased current density may be achieved by distributing approximately the same amount of electro-catalyst over a larger membrane surface, resulting in higher voltage efficiency of the electrolyzer (paragraph 8). It is well known that current and voltage are related through Ohm's law (V=IR).

Therefore, it would have been obvious to a person of ordinary skill in the art to modify the current density (and thus the voltage) by modifying the amount of electro-catalyst and area of

the membrane surface in order to arrive at the desired efficiency of the electrolyzer. The discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980) (see MPEP § 2144.05, II.).

Regarding claims 58-62, Kosek teaches a system in which a fuel that may be a mixture of water and methanol is fed to the anode 16 of the hydrogen generation stack 12 where methanol is decomposed and protons and water ("oxidizing agent(s)") migrate across the membrane to the cathode where 20 where the proton accepts electrons and the formation of hydrogen gas is complete (see Figure 1 and paragraphs 16-17). The amount of hydrogen gas produced along with the amount of protons and water ("oxidizing agent(s)") that migrate across the membrane depend directly upon the voltage between the anode 16 and cathode 20 that allow the electrolyer to run and the volumes and concentrations of the methanol/water ("fuel") and protons/water ("oxidizing agent(s)") provided to the hydrogen generation stack 12 (paragraph 2). Therefore, it is inherent to the system that the amount of hydrogen gas evolved is adjusted when these variables are varied. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. Inherency is not established by probabilities or possibilities. *In re Robertson*, 49 USPQ2d 1949 (1999).

Regarding claim 64, Kosek teaches that the preferred operating temperature range of the hydrogen generation system 12 is 25-80 °C (paragraph 33).

Regarding claims 65 and 66, Kosek teaches that the organic compound supplied to the fuel electrode may be methanol which is an alcohol (paragraph 34).

Regarding claim 67, Kosek teaches that the protons and some water are transported across the PEM to the cathode side of the cell 30. Thus, the "oxidizing agent" can also be viewed as the water that is transported across the PEM and as most of this is in vapor/gas form, the water ("oxidizing agent") is an oxygen containing gas.

Regarding claims 70 and 71, Kosek teaches that the ionic conductive membrane of the MEA may be a perfluorocarbon sulfonic acid membrane (paragraph 19).

Regarding claim 72, Kosek teaches that the electrodes of the MEA 100 include noble metal catalyst loadings including platinum and ruthenium that may be supported on carbon (see paragraph19; also see US Patent 4,311,569 which is incorporated into the teachings of Kosek and lists specific examples of platinum-ruthenium alloys). Furthermore, Narayanan also teaches that a platinum-ruthenium catalyst is used so that the only by-product of the electro-oxidation of methanol is carbon dioxide which is removed from the system (paragraphs 23 and 71).

Regarding claim 73, Kosek teaches that the electrodes of the MEA 100 include noble metal catalyst loadings including platinum which are supported by carbon or graphite as a base (paragraph 19).

Regarding claim 74, Kosek illustrates that the fuel containing methanol and water is circulated through the hydrogen generating stack 12 (see the arrows flowing into and out of the stack in Figure 1).

Regarding claim 76, modified Kosek shows the hydrogen produced by the electrolyzer 100 is supplied directly the fuel cell 520 without being cooled (see Figure 5 of Narayanan and the rejection of claim 1 for more details).

Regarding claim 77, Kosek does not teach that an insulating material for insulating a heat generated by the hydrogen generating device is provided as claimed.

4. Claim 68 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kosek et al. in view of Narayanan et al. and evidenced by "Chemical Reaction" from Britannica Online Encylopedia as applied to claims 47, 51-53, 58-62, 64, 65, 67, 70-74, 76 and 77 above, and further in view of Hsu (US Patent 5,948,221).

Regarding claim 68, Kosek does not teach that the oxidizing agent is exhaust air exhausted from the fuel cell; however, it is well known in the art to recycle exhaust air from a fuel cell to provide to for reforming use (i.e. – hydrogen production). This is taught by Hsu who teaches a fuel cell array in which the exhaust is recycled and collected for hydrogen production (column 14, lines 57-65).

Therefore, it would have been obvious to a person of ordinary skill in the art to modify the invention of Kosek to recycle the fuel cell exhaust to the hydrogen generating device because Hsu teaches such a system and notes that the system provides a simplified and improved electrochemical converter energy system that extracts waste heat generated by the fuel cell which allows for increased efficiency of the energy system (column 2, lines 12-20).

5. Claim 69 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kosek et al. in view of Narayanan et al. and evidenced by "Chemical Reaction" from Britannica Online Encylopedia as applied to claims 47, 51-53, 58-62, 64, 65, 67, 70-74, 76 and 77 above, and further evidenced by Lehmann et al. (US Patent Application 2002/0036147).

Regarding claim 69, Kosek teaches that the electrolyzer used may be a sodium sulfate electrolyzer wherein soldium sulfate/sulfuric acid is supplied to the anode ("fuel electrode") as a fuel. Lehmann gives evidence that in such an electrolysis cell, a hydrogen peroxide solution migrates across the membrane (paragraph 5). Thus, in this case, the "oxidizing agent" supplied to the cathode in the electrolyzer or Kosek is a hydrogen peroxide solution.

6. Claim 75 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kosek et al. in view of Narayanan et al. and evidenced by "Chemical Reaction" from Britannica Online Encylopedia as applied to claims 47, 51-53, 58-62, 64, 65, 67, 70-74, 76 and 77 above, and further in view of Moulthrop, Jr. et al. (US Patent 6,383,361).

Regarding claim 75, Kosek does not disclose a carbon dioxide absorbing portion in the hydrogen generating stack; however, Moulthrop teaches that the hydrogen gas produced through electrolytic methods often includes carbon dioxide which contaminates the electrolyte membrane catalysts thereby decreasing the operation efficiency and contaminating the product gas stream. As such, Moulthrop provides filters to purify/absorb the carbon dioxide produced by the electrolytic cell (column 1, lines 26-62).

Therefore, it would have been obvious to a person of ordinary skill in the art to modify the electrolytic cell of Kosek to include a carbon dioxide filtration or absorption system because Moulthrop teaches such a system and that carbon dioxide produced along with the hydrogen gas in an electrolytic cell needs to be removed as it contaminates the membrane catalysts and product stream and decreases operation efficiency (column 1, lines 26-62).

Allowable Subject Matter

7. Claim 48 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 48 is allowable because the prior art does not teach that the hydrogen generating device is an open circuit having neither means for withdrawing electric energy to outside from a hydrogen generating cell constituting the hydrogen generating device, nor means for providing electric energy from outside to the hydrogen generating cell as recited in the claim.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMANDA BARROW whose telephone number is (571)270-7867. The examiner can normally be reached on 7:30am-5pm EST. Monday-Friday, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AMANDA BARROW/
Examiner, Art Unit 1795

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1795